

## TROPICAL FOREST RAPTORS IN INDONESIA: RECENT INFORMATION ON DISTRIBUTION, STATUS, AND CONSERVATION

S. (BAS) VAN BALEN

*BirdLife International–Indonesia Programme, P.O. Box 310, BOGOR 16003, Indonesia; and Department of Terrestrial Ecology and Nature Conservation, Wageningen Agricultural University, Bornsesteeg 69, 6708 PD Wageningen, The Netherlands*

**ABSTRACT.**—In Indonesia (subregions Sumatra, Kalimantan, Java/Bali, Sulawesi, Lesser Sundas, Moluccas, and Irian Jaya), 68 species of diurnal birds of prey, nine of which are endemic to the region, are known to occur. Ever-growing pressure on natural habitats, in particular the timber-rich, tropical rainforests, as well as hunting and the use of pesticides, is believed to have major impacts on the numbers and distribution of these species. The status of 20 species is a matter of concern since three species are considered globally Threatened and eleven others are Near Threatened. The status of yet another five species is of local concern as they are widespread and relatively common elsewhere.

**KEY WORDS:** *status diurnal birds of prey; conservation; distribution; Indonesia.*

---

Aves rapaces de bosques tropicales en Indonesia: información reciente sobre su distribución, estado, y conservación

**RESUMEN.**—En Indonesia (subregiones de: Sumatra, Kalimantan, Java/Bali, Sulawesi, Lesser Sundas, Moluccas, y Irian Jaya), existen 68 especies de aves rapaces diurnas, nueve de las cuales son endémicas a la región. La presión constante sobre los habitats, en particular sobre los bosques de lluvia ricos en madera, como también la caza y el uso de pesticidas han tenido un impacto importante en la población y distribución de estas especies. El estado de 20 especies es un aspecto alarmante debido a que tres especies son consideradas como globalmente amenazadas y otras once como cercanamente amenazadas. El estado de las otras cinco especies es preocupante a nivel local únicamente debido a que tienen una distribución amplia y son relativamente comunes en otras áreas.

[Traducción de César Márquez]

Straddling the equator over a distance of 4500 km, the republic of Indonesia has about 1539 bird species. Of these, 381 are endemic (Andrew 1992, 1993) and the country ranks among the five bird-richest in the world (Groombridge 1994). There are 68 species of birds of prey, and many are forest dwellers, occupying many niches, with  $\geq 30$  species on the largest islands, and at least two or three species on even the smallest oceanic islands (Appendix 1). Many of Indonesia's species are among the world's least known (Meyburg 1986) because they are restricted to remote, little known places. Most research on these species has been taxonomic and was carried out in the decades before or around the turn of this century. Our knowledge on the biology and ecology on Indonesian raptors has been and is still fragmentary. In this paper, I try to summarize work done so far on raptors in Indonesia and identify gaps in our knowledge, as-

sess the status of a number of selected species, evaluate the current protection system, and give recommendations for future research and protection measures. Although only part of the Indonesian raptor fauna is presumed to be dependent on forests, none can survive without some kind of woodland. Therefore, I have considered both forest and nonforest raptors.

### STUDIES, PAST AND PRESENT

The first written scientific report of raptors in Indonesia was made by a merchant, Baron Von Wurmb (1779–82) who described a hawk and the Brahminy Kite (*Haliastur indus*). In subsequent centuries, most studies of birds in Indonesia focused on collecting specimens; nevertheless, they produced a relatively accurate distribution map for raptors across the archipelago, with standard annotated checklists developed for Sulawesi, Lesser

Table 1. Recent raptor studies conducted in Indonesia.

REFERENCES	RESEARCH SUBJECT	TAXA
1. Ash 1984, 1993	Autumn migration in NW Bali	Migratory raptors
2. Thiollay and Meyburg 1988	Forest fragmentation and raptor conservation on Java	Falconiformes
3. van Balen et al. 1993	Conservation status on Java	<i>Haliastur indus</i>
4. Meyburg and van Balen 1994	Conservation on Sulawesi	Falconiformes
5. van Balen and Meyburg 1994; Sözer and Nijman 1995	Conservation, ecology and distribution	<i>Spizaetus bartelsi</i>
6. Thiollay 1996a,b	Conservation, ecology and distribution on Sumatra	Falconiformes

Sundas and Moluccas (White and Bruce 1986), and Sumatra (van Marle and Voous 1988). Similar checklists are currently being written for Java, Bali, and Borneo, but locations such as Irian Jaya (e.g., western New Guinea) still need to be studied. During the past decade, the study of raptors in Indonesia has experienced considerable growth and studies are currently being undertaken on the Gurney's Eagle (*Aquila gurneyi*) and Javan Hawk-eagle (*Spizaetus bartelsi*) (N. Røv and J.O. Gjershaug pers. comm.; T. Yamazaki pers. comm.).

#### NATIONAL OVERVIEW

Indonesia's 17 000 islands show a great variety in habitats, influenced by climate, edaphic factors, topography, and human interference. On Java and most of the Lesser Sundas, high human population pressure, dating back from ancient times, has had far-reaching effects on natural ecosystems. In the past few decades, high technology and extensive exploitation of natural resources have increased this pressure from people at an alarming rate (Table 2).

**Java and Bali.** Largely deforested, Java and Bali are essentially a mosaic of paddy fields, cities, and villages in the low lands, with most forest fragments covering the numerous volcanoes on the two is-

lands. The most developed forest reserve system in Indonesia is located on these islands. However, due to extreme population pressure, many reserves established in the first half of this century are small and have probably lost most of their species diversity. Because of extreme habitat fragmentation, the endemic Javan Hawk-eagle is considered to be Endangered (Collar et al. 1994). Development has been most concentrated in open woodland areas, where five raptor species, the Brahminy Kite, Rufous-winged Buzzard (*Butastur liventer*), Black-winged Kite (*Elanus caeruleus*), Changeable Hawk-eagle (*Spizaetus cirrhatus*), and Spotted Kestrel (*Falco moluccensis*), are disappearing (Thiollay and Meyburg 1988, van Balen et al. 1993, Holmes 1995).

**Lesser Sundas.** Burning, wood collection, and inefficient subsistence agriculture have long been destructive forces to the forests of these islands. The countless islands of the Lesser Sundas are covered in a parklike landscape of extensive grasslands, thickets, and wooded river valleys. The most extensive forests are on Sumbawa and north Flores where there are few people. The conservation area network in the Lesser Sundas is insufficient (Sujatnika et al. 1995), but the typical park landscapes seem to favor a relatively diverse raptor fauna in-

Table 2. Land use and the human population in Indonesia (after Sujatnika et al. 1995).

	TOTAL AREA ( $\times 10^6$ HA)	FOREST (%)	DEVELOPMENT AREA (%)	POPULATION ( $\times 10^6$ )	DENSITY (PER km <sup>2</sup> )	GROWTH RATE (%)
Kalimantan	53.95	74	23	9.10	17	3.5
Irian Jaya	42.20	85	28	1.65	4	3.5
Sulawesi	18.92	59	40	12.52	66	2.0
Sumatra	47.34	49	45	36.51	77	3.0
Java/Bali	13.77	10	72	110.36	801	1.8
Lesser Sundas	8.29	18	49	7.39	89	2.3
Moluccas	7.45	74	38	1.86	24	2.8

cluding Short-toed Eagles (*Circaetus gallicus*), Bonelli's Eagles (*Hieraaetus fasciatus*), Changeable Hawk-eagles, Variable Goshawks (*Accipiter novaehollandiae*), and Brown Goshawks (*A. fasciatus*).

**Sumatra.** The larger part of the Sumatran lowland rainforest has been logged or is under a production regime. Mountain forests are relatively secure, though degradation and encroachment on lower slopes is widely reported (Sujatnika et al. 1995). Small islands with distinct races of raptors are found off west Sumatra, notably Nias Island (e.g., Thiollay 1996b). Separated by mainland Malaysia by only a narrow sea strait, Sumatra is an important passage and wintering area for southern bound migratory raptors from northern temperate regions.

**Kalimantan (Former Dutch Borneo).** Until recently, extensive rainforest covered most of the island, but conversion into plantations, wasteland (notably alang-alang [*Imperata cylindrica*] grassfields), and secondary growth is beginning to dominate the landscape. The island's endemic raptors, the Mountain Serpent-eagle (*Spilornis kinabaluensis*) and White-fronted Falconet (*Microhierax latifrons*) are restricted to the northern, non-Indonesian part of the island.

**Sulawesi (Former Celebes).** Extensive lowland rainforest still covers Sulawesi, although mainly at moderate altitudes. In southwest Sulawesi, the sparse forest is only on high mountain tops, whereas extensive lowlands and hill forests still cover central Sulawesi. Agriculture, transmigration, and logging continue to absorb large areas of lowland forest. Montane forest is relatively untouched, although some encroachment occurs on the lower slopes (Sujatnika et al. 1995). Despite harsh climatic conditions and deforestation, Coomans de Ruiter (1947) reported more raptors in southwest Sulawesi than anywhere else. Nevertheless, the formerly common Black Kite (*Milvus migrans*) has decreased in numbers (Meyburg and van Balen 1994). The status of the three endemic *Accipiters* is largely unknown, partly because of identification problems.

**Moluccas.** Originally, the numerous islands of Moluccas were covered in tropical rainforest. High quality timber, and local climatic and edaphic conditions attracted loggers and led to the development of plantations of nutmeg and cloves. As a result, lowland forests have rapidly disappeared, and little virgin forest remains. The largest stretches of remaining original forest are found on Ser-

am, Buru, and Halmahera (Poulsen pers. comm.). These areas support Rufous-necked Sparrowhawks (*Accipiter erythrauchen*), Moluccan Goshawks (*A. henicogrammus*), and a number of endemic races.

**Irian Jaya (Former Dutch New Guinea).** Irian Jaya comprises the second largest and most pristine region in Indonesia. However, development from mining, logging, resettlement schemes, and infrastructure improvement is proceeding rapidly. Two large forest eagles in this area, the New Guinea Harpy Eagle (*Harpyopsis novaeguineae*) and Gurney's Eagle (*Aquila gurneyi*), are presumably still safe, but monitoring is needed to ensure that they continue to do well.

#### CONSERVATION OF INDONESIAN RAPTORS

There are 20 species of raptors that are globally Threatened and Near Threatened with extinction (Collar et al. 1994), or may be classified as such, pending further field research. The number of open woodland and forest edge species that are listed is striking.

One of the greatest threats to these raptors is the loss of habitat. Large trees for perches, roosts, and nests are important components of raptor habitat (Janes 1985). Huge islands like Kalimantan and Irian Jaya seem well-forested and secure (Table 2), but present human population growth and habitat conversion may soon alter this. Therefore, management of the existing forest reserve systems needs to be improved without delay.

Hunting also poses a serious threat to raptors on Java and most other regions in Indonesia. With the immensely increased number of air rifles accompanying the nation's overall improved standard of life, raptors, like many other birds, have been decimated, especially near settlements.

With more people that can afford the high price and care of pet eagles and hawks, the demand for wild birds is high, despite legal protection of all diurnal raptors.

It is not clear if pesticides have played a major role in the decline of Brahminy Kites on Java. Nevertheless, a recent decline in the species reported from Laos indicates that the species may be undergoing a widespread decline in Southeast Asia (Thewlis et al. 1995). A coincident increase in use of pesticides on Java and Bali in the 1970s (van Balen et al. 1993) and the overall decline of Pond Herons (*Ardeola speciosa*) and egrets (*Egretta* spp., van Helvoort 1981) is striking. The ban on 57 varieties of organophosphate chemicals since 1986

Table 3. Indonesian raptors of conservation concern, threats to their survival, and research needs.

SPECIES	THREATS <sup>1</sup>	TREND	RDB STATUS	RESEARCH NEEDS	END-EMIC TAXA	REFS.
<i>Aviceda jerdoni</i>	1, 2	?<	?NT	monitoring	2	2
<i>Pernis ptilorhynchus</i>	1, 2, 3	?=	—	taxonomy	1	3
<i>Macheiramphus alcinus</i>	1, 4, 7	?<(B)	—	monitoring	—	4
<i>Elanus caeruleus</i>	4, 5	<<(J,S)	—	monitoring	1	4, 5
<i>Haliastur indus</i>	?1, ?4, 5, 6	<<(J)	—	monitoring	—	1
<i>Ichthyophaga humilis</i>	1, 2	<	?NT	monitoring	—	2
<i>Ichthyophaga ichthyaetus</i>	1, ?4, ?5	?<	?NT	monitoring	—	2
<i>Accipiter henicogrammus</i>	1, ?3	<	?	ecology	1	6
<i>Accipiter erythrauchen</i>	1, 2, 3	?<	?	ecology	2	6
<i>Accipiter nanus</i>	?3	?<	NT	ecology	1	2
<i>Accipiter buergeri</i>	7	?=	DD	ecology	—	2
<i>Accipiter doriae</i>	1, 2, 3	?=	NT	ecology	—	2
<i>Butastur liventer</i>	1, ?3, ?4	<(J)	NT	monitoring	—	2
<i>Harpyopsis novaeguineae</i>	?3, 4, 7	?=	V	ecology	—	2
<i>Aquila gurneyi</i>	1	?=	NT	ecology	—	2
<i>Spizaetus cirrhatus</i>	1, 4, ?5	<(J)	—	monitoring	2	4
<i>Spizaetus bartelsi</i>	1, 3, 4, 7	?<<	E	ecology	1	2
<i>Spizaetus nanus</i>	1, 3	?<	V	ecology	1	2
<i>Spizaetus lanceolatus</i>	1, 2	?=	NT	ecology	1	2
<i>Falco moluccensis</i>	4, ?5	<(J,S)	—	monitoring	2	5

<sup>1</sup> Threats: 1—habitat loss; 2—habitat degradation; 3—forest fragmentation; 4—hunting; 5—pesticides; 6—improved sanitation; 7—low density/small population. Trend: <—decrease; <<—dramatic decrease; = — (presumably) stable; J—Java; S—Sulawesi; B—Borneo. RDB Status or Global Conservation Status (after Collar et al. 1994): E—Endangered; V—Vulnerable; DD—data-deficient; NT—Near Threatened; ?—possible candidate. Refs.: 1—Van Balen et al. 1993; 2—Collar et al. 1994; 3—del Hoyo et al. 1994; 4—van Balen 1994; 5—Holmes 1995; 6—M. Poulsen and D. Permiassa pers. comm.

(Whitten et al. 1996) has not yet resulted in an increase in either of these species.

Decreased food availability associated with the growing human population and increased sanitation have perhaps affected only a few, scavenging raptors (e.g., Brahminy Kite in large cities on Java [van Balen et al. 1993]).

#### RESEARCH

There are several specific areas where further research is necessary on Indonesian raptors (Table 3). It is not yet known what the long-term impact of logging will be on raptor populations in Indonesia. Selective logging leaves a relative high forest cover which supports widespread populations of raptors. Several species of raptors in Indonesia are so poorly studied that their taxonomic status may change as information on them increases (Sujatnika et al. 1995). A number of island races, some vulnerable to extinction, may prove to be full species, such as *Accipiter griseogularis* comprising *A. novaehollandiae obiensis* of Obi Island, *A. n. griseogularis*

of Bacan and Halmahera Islands, and *A. n. mortyi* of Morotai Island (White and Bruce 1986); *Spizaetus cirrhatus floris* of Sumbawa and Flores Islands, *Spizaetus nanus stresemanni* of Nias Island, and *Pernis p. ptilorhynchus* of Java and *P. p. torquatus* of Sumatra, Borneo, and peninsular Malaysia (del Hoyo et al. 1994). Only fragmentary information is available on migration routes of northern migratory raptors. Bali Strait (Ash 1984, 1993), the eastern part of the Java Sea (J.H. Becking pers. comm.), and the Puncak pass in west Java are known as passage points, but huge stretches in between and beyond need to be investigated.

#### RECOMMENDATIONS AND CONCLUSIONS

Future raptor studies in Indonesia should focus on the causes of declines of formerly common open woodland species, habitat use and measurement of home ranges of raptors, effects of habitat degradation and forest fragmentation, and migration routes of raptors over Indonesia.

Large areas of Sulawesi, the Moluccas, Kaliman-

tan, and other areas virtually are unexplored. The possible addition of additional natural areas that might be added to the current network is urgent.

Raptors are either persecuted because they are suspected of killing domestic fowl or because they are sought as pets, especially the rarer ones. Public education needs to be undertaken at all levels through the use of posters, television spots, and newspaper articles to increase awareness of the importance of raptors. Local bird-watching clubs should be supported in monitoring the passage of migratory raptors as well resident raptors.

Captive breeding has become a popular issue, and often too quickly considered the most important solution to preserve a particular rare species. The Javan Hawk-eagle has recently been indicated as a candidate for such a program. Before steps are taken towards establishing a captive population, further consideration should be given to the contribution of such a program to conservation of the species, its effect on the wild population, and the availability of secure habitat for reintroduced birds.

A steering committee of local and international experts in the field of raptor ecology and conservation should supervise any future conservation action. Major steps have already been made by the adoption of an Action Plan by the "Focus Group for Javan Hawk-eagle Conservation" and the establishment by the State Minister of Environment in January 1997 of the "Working Group for Management of Indonesian Raptor Areas." Both initiatives are cooperative activities of the State Ministry of Environment, the Directorate General of Forest Protection and Nature Conservation (PHPA) and the Indonesian Institute of Sciences (LIPI) involving various national and international organizations, including BirdLife International-Indonesian Programme.

The commitment of Indonesia's Government to preserve its local wildlife is attested to by the adoption of two of its birds of prey as the mascot of Jakarta (Brahminy Kite) and as a national symbol (Javan Hawk-eagle). The former is Indonesia's most ubiquitous raptor and the second is one of its rarest birds of prey.

#### ACKNOWLEDGMENTS

I would like to thank the Peregrine Fund and Dr. Rick Watson in particular for financial support to attend the symposium. Paul Jepson, Michael Poulsen, Prof. C.M. White and an anonymous reviewer gave useful comments on drafts of the paper, for which I am very grateful.

#### LITERATURE CITED

- ANDREW, P. 1992. The birds of Indonesia. A checklist (Peters' Sequence). Indonesian Ornithological Society, Jakarta, Indonesia.
- . 1993. The birds of Indonesia, Kukila checklist No. 1. Additions, corrections and notes—1. *Kukila* 6: 47–52.
- ASH, J.S. 1984. Bird observations on Bali. *Bull. Br. Ornithol. Club* 104:24–35.
- . 1993. Raptor migration on Bali. *Forktail* 9:3–11.
- COLLAR, N.J., M.J. CROSBY AND A.J. STATTERSFIELD. 1994. Birds to watch: the world list of threatened birds. BirdLife International, Cambridge, U.K.
- COOMANS DE RUITER, L. 1947. Roofvogelwaarnemingen in Zuid-Celebes. *Limosa* 20:213–229.
- DEL HOYO, J., A. ELLIOTT AND J. SARGATAL. 1994. Handbook of the birds of the world. Vol. 2. Lynx Edicions, Barcelona, Spain.
- GROOMBRIDGE, B. [ED.]. 1994. Biodiversity data sourcebook. World Conservation Monitoring Centre. World Conservation Press, Cambridge, U.K.
- HOLMES, D.A. 1995. Editorial. *Kukila* 7:85–90.
- JANES, S.W. 1985. Habitat selection in raptorial birds. Pages 159–188 in M.L. Cody [ED.], Habitat selection in birds. Academic Press, Orlando, FL U.S.A.
- MACKINNON, J. AND J. WIND. 1980. Birds of Indonesia. FAO, Bogor, Indonesia.
- MEYBURG, B.-U. 1986. Threatened and near-threatened diurnal birds of prey of the world. *Birds of Prey Bull.* 3:1–12.
- AND S. VAN BALEN. 1994. Raptors on Sulawesi (Indonesia): the influence of rainforest destruction and human density on their populations. Pages 269–276 in B.-U. Meyburg and R.D. Chancellor [EDS.], Raptor conservation today. World Working Group for Birds of Prey and Owls, London, U.K.
- SÖZER, R. AND V. NIJMAN. 1995. Behavioral ecology, distribution and conservation of the Javan Hawk-eagle *Spizaetus bartelsi* Stresemann, 1924. Verslagen en Technische Gegevens No. 20. Institute of Systematics and Population Biology, Univ. Amsterdam, The Netherlands.
- SUJATNIKA, P., P.R. JEPSON, T. SOEHARTONO, M.J. CROSBY AND A. MARDIASTUTI. 1995. Conserving Indonesian biodiversity: the endemic bird area approach. PHPA and BirdLife International-Indonesia Programme, Jakarta, Indonesia.
- THEWLIS, R.M., J.W. DUCKWORTH AND G.Q.A. ANDERSON. 1995. Ornithological records from Laos. *Forktail* 11: 47–100.
- THIOLLAY, J.-M. 1996a. Rainforest raptor communities in Sumatra: the conservation value of traditional agroforests. Pages 245–260 in D.M. Bird, D.E. Varland and J.J. Negro [EDS.], Raptor adaptations to human influenced environments. Academic Press, London, U.K.

- . 1996b. The raptor community of Nias Island, Sumatra: survey and conservation. *Kukila* 8:113–116.
- AND B.-U. MEYBURG. 1988. Forest fragmentation and the conservation of raptors: a survey on the island of Java. *Biol. Conserv.* 44:229–250.
- VAN BALEN, S. 1994. The status and conservation of birds of prey in the Sondaic and Wallacean regions of Indonesia. Pages 245–254 in B.-U. Meyburg and R.D. Chancellor [EDS.], Raptor conservation today. World Working Group for Birds of Prey and Owls, London, U.K.
- AND B.-U. MEYBURG. 1994. The Java Hawk-eagle *Spizaetus bartelsi*: results of recent research on distribution status and ecology. Pages 89–92 in B.-U. Meyburg and R.D. Chancellor [EDS.], Raptor conservation today. World Working Group for Birds of Prey and Owls, London, U.K.
- , I.S. SUWELo AND D.S. HADI. 1993. The decline of the Brahminy Kite *Haliastur indus* on Java. *Forktail* 8:83–88.
- VAN HELVOORT, B. 1981. Bird populations in the rural ecosystems of West Java. Student Report No. 560. Agricultural Univ., Wageningen, The Netherlands.
- VAN MARLE, J.G. AND K.H. VOOUS. 1988. The birds of Sumatra. B.O.U. Check-list 10. British Ornithologists' Union, London, U.K.
- VON WURMB, F. 1779–1782. Verhandelingen van het Bataviaasche Genootschap van Kunsten en Wetenschappen. Vol. 1–4.
- WHITE, C.M.N. AND M.D. BRUCE. 1986. The birds of Wallacea (Sulawesi, the Moluccas and Lesser Sunda Islands, Indonesia): an annotated check-list. B.O.U. Check-list 7. British Ornithologists' Union, London, U.K.
- WHITTEN, T., R.E. SOERIAATMADJA AND S.A. AFIFF. 1996. The ecology of Java and Bali. Periplus, Singapore.

Received 16 October 1996; accepted 11 November 1997

Appendix 1. Distribution of raptors in Indonesia. Sequence, nomenclature, and subregional boundaries follow Andrew (1992).

	R <sup>1</sup>	S	DISTRIBUTION							HABITAT
Osprey ( <i>Pandion haliaetus</i> )	<>	R/M	JB	T	S	K	C	M	I	C
Jerdon's Baza ( <i>Aviceda jerdoni</i> )	<	R	-	-	S	K	C	M	-	LR/SR/SS
Pacific Baza ( <i>Aviceda subcristata</i> )	>	R	-	T	-	-	C	M	I	LM/R/SR/SS
Black Baza ( <i>Aviceda leuphotes</i> )	<	M	J	-	S	-	-	-	-	SS/A
Long-tailed Buzzard ( <i>Henicopernis longicauda</i> )	P	R	-	-	-	-	-	-	I	LR/SR
Oriental Honey-buzzard ( <i>Pernis ptilorhynchus</i> )	<	R/M	JB	T	S	K	C	M	-	LR/FE/SS
Barred Honey-buzzard ( <i>Pernis celebensis</i> )	<	R	-	-	-	-	C	-	-	LR/FE
Bat Hawk ( <i>Macheiramphus alcinus</i> )	<P	R	-	-	S	K	C	-	-	LM/LR/FE
Black-winged Kite ( <i>Elanus caeruleus</i> )	<P	R	JB	T	S	K	C	-	I	LM/FE/G/SS
Black Kite ( <i>Mitvus migrans</i> )	<>	R/M	-	T	S	-	C	M	I	LM/FE/G/SS
Whistling Kite ( <i>Haliastur sphenurus</i> )	>	R	-	-	-	-	-	-	I	F/G/SS
Brahminy Kite ( <i>Haliastur indus</i> )	<>	R	JB	T	S	K	C	M	I	F/C/G/SS
White-bellied Sea-eagle ( <i>Haliaeetus leucogaster</i> )	<>	R	JB	T	S	K	C	M	I	F/C
Lesser Fish-eagle ( <i>Ichthyophaga humilis</i> )	<	R	-	-	S	K	C	-	-	F/C
Grey-headed Fish-eagle ( <i>Ichthyophaga ichhyaetus</i> )	<	R	J	-	S	K	C	-	-	F
Short-toed Eagle ( <i>Circaetus gallicus</i> )	<	R	JB	T	-	-	-	-	-	LM/FE/G/SS
Crested Serpent-eagle ( <i>Spilornis cheela</i> )	<	R	JB	-	S	K	-	-	-	LR/SR/SS
Sulawesi Serpent-eagle ( <i>Spilornis rufipectus</i> )	E	R	-	-	-	-	C	-	-	LR/SR/G/SS
Spotted Harrier ( <i>Circus assimilis</i> )	>	R/M	-	T	-	-	C	-	-	G/SS
Pied Harrier ( <i>Circus melanoleucos</i> )	<	V	-	-	-	K	-	-	-	F/G/SS
Western Marsh-harrier ( <i>Circus aeruginosus</i> )	<	V	-	-	S	-	-	-	-	F/G
Eastern Marsh-harrier ( <i>Circus spilnotus</i> )	<P	M	-	-	S	-	-	-	I	F/G
Swamp Harrier ( <i>Circus approximans</i> )	>	M	-	-	-	-	-	-	I	F/S
Crested Goshawk ( <i>Accipiter trivirgatus</i> )	<	R	J	-	S	K	-	-	-	LR
Sulawesi Goshawk ( <i>Accipiter griseiceps</i> )	E	R	-	-	-	-	C	-	-	LR
Shikra ( <i>Accipiter badius</i> )	<	M	-	-	S	-	-	-	-	LR
Chinese Goshawk ( <i>Accipiter soloensis</i> )	<	M	JB	T	S	K	C	M	I	LM/FE/LR
Spot-tailed Goshawk ( <i>Accipiter trinotatus</i> )	E	R	-	-	-	-	C	-	-	LR/SR
Brown Goshawk ( <i>Accipiter fasciatus</i> )	>	R	-	T	-	-	C	M	I	LR/SR
Grey Goshawk ( <i>Accipiter novaehollandiae</i> )	>	R	-	T	-	-	-	M	I	F/LR/G/FE/SS
Black-mantled Goshawk ( <i>Accipiter melanochlamys</i> )	P	R	-	-	-	-	-	-	I	MR
Moluccan Goshawk ( <i>Accipiter henicogrammus</i> )	E	R	-	-	-	-	-	M	-	LR
Grey-headed Goshawk ( <i>Accipiter poliocephalus</i> )	P	R	-	-	-	-	-	-	I	LR/FE/SS
Japanese Sparrowhawk ( <i>Accipiter gularis</i> )	<	M	JB	T	S	K	C	-	-	LM/LR/FE/SS
Besra ( <i>Accipiter virgatus</i> )	<	R	JB	T	S	K	-	-	-	LR/SR/MR
Small Sparrowhawk ( <i>Accipiter nanus</i> )	E	R	-	-	-	-	C	-	-	LR/SR/MR
Collared Sparrowhawk ( <i>Accipiter cirrocephalus</i> )	>	R	-	-	-	-	-	-	I	LR
Rufous-necked Sparrowhawk ( <i>Accipiter erythrauchen</i> )	E	R	-	-	-	-	-	M	-	LR
Vinous-breasted Sparrowhawk ( <i>Accipiter rhodogaster</i> )	E	R	-	-	-	-	C	-	-	LR
Meyer's Goshawk ( <i>Accipiter meyerianus</i> )	>	R	-	-	-	-	-	M	I	LR
Chestnut-shouldered Goshawk ( <i>Accipiter buergersi</i> )	P	R	-	-	-	-	-	-	I	SR
Doria's Hawk ( <i>Accipiter doriae</i> )	P	R	-	-	-	-	-	-	I	LR/SR
Rufous-winged Buzzard ( <i>Butastur liventer</i> )	<	R	J	-	-	-	C	-	-	LM/LR/SR/G/SS
Grey-faced Buzzard ( <i>Butastur indicus</i> )	<	M	J	?	S	-	C	M	I	FE/LM/LR/G/SS
Common Buzzard ( <i>Buteo buteo</i> )	<	M	JB	-	-	-	-	-	-	FE/G/SS
New Guinea Eagle ( <i>Harpyopsis novaeguineae</i> )	P	R	-	-	-	-	-	-	I	LR/SR/MR/FE
Black Eagle ( <i>Ictinaetus malayensis</i> )	<	R	JB	-	S	K	C	M	-	LR/SR
Spotted Eagle ( <i>Aquila clanga</i> )	<	V	-	-	S	-	-	-	-	C
Gurney's Eagle ( <i>Aquila gurneyi</i> )	P	R	-	-	-	-	-	M	I	C/F/LR/G
Wedge-tailed Eagle ( <i>Aquila audax</i> )	>	R	-	-	-	-	-	-	I	F/G
Bonelli's Eagle ( <i>Hieraetus fasciatus</i> )	<	R	-	T	-	-	-	-	-	LM/FE
Booted Eagle ( <i>Hieraetus pennatus</i> )	<	V	J	-	-	-	-	-	-	LR

## Appendix 1. Continued.

	R <sup>1</sup>	S	DISTRIBUTION							HABITAT
Little Eagle ( <i>Hieraaetus morphnoides</i> )	>	R	-	-	-	-	-	M	I	LR/SR
Rufous-bellied Eagle ( <i>Hieraaetus kienerii</i> )	<	R	JB	T	S	K	C	M	-	LR
Changeable Hawk-eagle ( <i>Spizaetus cirrhatus</i> )	<	R	JB	T	S	K	-	-	-	LM/LR/FE/G/SS
Javan Hawk-eagle ( <i>Spizaetus bartelsi</i> )	E	R	J	-	-	-	-	-	-	LR/SR
Sulawesi Hawk-eagle ( <i>Spizaetus lanceolatus</i> )	E	R	-	-	-	-	C	-	-	LR/SR
Blyth's Hawk-eagle ( <i>Spizaetus alboniger</i> )	<	R	-	-	S	K	-	-	-	SR/MR
Wallace's Hawk-eagle ( <i>Spizaetus nanus</i> )	<	R	-	-	S	K	-	-	-	LR
Black-thighed Falconet ( <i>Microhierax fringillarius</i> )	<	R	JB	-	S	K	-	-	-	LR/FE/SS
Brown Falcon ( <i>Falco berigora</i> )	>	R	-	-	-	-	-	-	I	LR/SR/MR/G/SS
Eurasian Kestrel ( <i>Falco tinnunculus</i> )	<	M	-	-	S	-	-	-	-	G/SS
Spotted Kestrel ( <i>Falco moluccensis</i> )	E	R	JB	T	-	K	C	M	I	G/SS
Australian Kestrel ( <i>Falco cenchroides</i> )	>	V	J	T	-	-	-	-	M	I G
Eurasian Hobby ( <i>Falco subbuteo</i> )	<	V	J	T	-	-	-	-	-	FE/G/SS
Oriental Hobby ( <i>Falco severus</i> )	<>	R	JB	T	S	K	C	M	I	LR
Australian Hobby ( <i>Falco longipennis</i> )	>	R/M	-	T	-	-	C	M	I	FE
Peregrine Falcon ( <i>Falco peregrinus</i> )	<>	R/M	JB	T	S	K	C	M	I	FE/G

<sup>1</sup> R (Range): <—western extension; >—eastern extension; E—endemic Indonesia; P—found in PNG. (S) Status: R—resident; M—migrant; V—vagrant. Distribution: JB—Java/Bali; T—Lesser Sundas; S—Sumatra; K—Kalimantan; C—Sulawesi; M—Moluccas; I—Irian Jaya (after Andrew 1992, 1993). Habitat: LM—lowland monsoon forest; LR—lowland rainforest; SR—submontane rainforest; MR—montane rainforest; C—coastal and mangrove forest; F—freshwater bodies; S—swamp forest; FE—forest edge; SS—secondary forest/scrub; G—grass and open woodland; A—agricultural land (after MacKinnon and Wind 1980, own observations).